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**Technical specification for electric vehicle intelligent  
bi-directional power supply equipment**

电动汽车智能充放电设备技术规范

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### 1 Scope

This document specifies the classification, the equipment composition, the operating conditions and the functional, safety and performance requirements for intelligent bi-directional power supply equipment for electric vehicles, together with the corresponding test methods.

It applies to equipment whose grid side and vehicle side both operate at up to 1 000 V AC or 1 500 V DC. Direct-current equipment works in charging mode 4 and is permanently connected to the grid; alternating-current equipment works in mode 3 with a case C connection, as defined in GB/T 18487.1-2023.

It applies only to grid-connected operation and does not cover islanded or isolated networks.

### 2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition, including all amendments, applies.

GB/T 12325 Power quality - Deviation of supply voltage · GB/T 12326 Power quality -

Voltage fluctuation and flicker · GB/T 14549 Quality of electric energy supply - Harmonics in public supply network · GB/T 15543 Power quality - Three-phase voltage unbalance · GB/T 15945 Power quality - Frequency deviation for power system · GB/T 18487.1-2023 Electric vehicle conductive charging system - Part 1: General requirements · GB/T 18487.5-2024 Electric vehicle conductive charging system - Part 5: DC charging system for GB/T 20234.3 · GB/T 20840.2 Instrument transformers - Part 2: Current transformers · GB/T 20840.3 Instrument transformers - Part 3: Inductive voltage transformers · GB/T 24337 Power quality - Interharmonics in public supply network · GB/T 29317-2021 Terminology of electric vehicle charging and battery swap infrastructure · GB 39752-2024 Safety requirements of electric vehicle conductive supply equipment · GB/T 40432-2021 Conductive on-board charger for electric vehicles · GB 44263-2024 Safety requirements for electric vehicle conductive charging system · NB/T 33001 Specification for electric vehicle off-board conductive charger · NB/T 33002 Specification for electric vehicle AC charging spot · NB/T 33008.1 Inspection and test specifications for electric vehicle charging equipment - Part 1: Off-board charger · NB/T 33008.2 Inspection and test specifications for electric vehicle charging equipment - Part 2: AC charging spot · NB/T 33021-2024 Specification for electric vehicle off-board bi-directional charger

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in GB/T 18487.1-2023, GB/T 29317-2021 and NB/T 33021-2024 apply, together with the following.

- 3.1 electric vehicle intelligent bi-directional power supply equipment. Equipment that transfers energy in both directions between an electric vehicle, or its traction battery, and the grid, and that responds to the dispatch commands of an upper-level system.
- 3.2 forward energy transfer. Transfer of energy from the grid to the vehicle, that is, charging.
- 3.3 reverse energy transfer. Transfer of energy from the vehicle to the grid, that is, discharging.
- 3.4 bi-directional energy transfer. The two taken together.
- 3.5 on-board charging and discharging charger. The on-board unit that performs bi-directional transfer in an alternating-current system.
- 3.6 electric vehicle AC bi-directional charging system. The system formed by the AC charging spot and the on-board charger-discharger.

### 4 General requirements

For direct-current equipment, the charging section shall meet GB 39752-2024, GB 44263-2024, GB/T 18487.1-2023, GB/T 18487.5-2024 and NB/T 33001, and shall be tested in accordance with NB/T 33008.1; the discharging section shall meet NB/T 33021-2024.

For alternating-current charging spots, the charging section shall meet GB 39752-2024, GB

44263-2024, GB/T 18487.1-2023 and NB/T 33002, and shall be tested in accordance with NB/T 33008.2; the on-board charger-discharger shall meet Annex A of GB/T 40432-2021.

## 5 Classification

Equipment is classified by the type of current used for the energy transfer, direct or alternating; by the voltage level of the grid connection - three-phase 400 V, single-phase 240 V, and direct-current networks, which are under consideration; and by the method of grid connection, distributed where a single unit is connected directly to the grid, or centralized where the connection passes through an integrated control cabinet at the vehicle-grid interface.

## 6 Equipment composition

In a distributed alternating-current arrangement, the internal protection is provided by the on-board charger-discharger and the grid-side protection by the AC charging spot. In a centralized arrangement, the grid-side protection sits in the integrated control cabinet.

## 7 Operating conditions

The environmental conditions follow NB/T 33001 and NB/T 33021 for direct-current equipment and NB/T 33002 for alternating-current equipment. The conditions of the grid connection are given in Table 1, and normal operation is defined within the limits of GB/T 14549, GB/T 24337, GB/T 12325, GB/T 12326, GB/T 15543 and GB/T 15945.

## 8 Functional requirements

Discharging may start only when the dispatch system has given permission through the digital protocol, the connector is reliably engaged, the vehicle has confirmed, and the voltage and frequency at the point of connection are stable.

Discharging shall stop on a stop command from the dispatch system, on any anomaly of the connection, the electronic lock or the control pilot, on a stop request from the vehicle or on reaching the minimum state of charge, on unstable voltage or frequency, and on other grid faults.

The equipment shall control the discharge dynamically from the commands of the vehicle and of the dispatch system, and shall accept manual commands for commissioning. Active power control on dispatch command is required; reactive power control is recommended.

It shall switch between charging and discharging, communicate digitally between the supply equipment controller and the vehicle controller, and stop with an alarm if that communication is lost.

The human-machine interface, through an application or a screen, shall show the state -

standby, charging, discharging, fault or alarm - and allow manual input, and shall display the state of charge, the voltage and the other operating values. Direct-current equipment shall pre-charge before discharging.

## 9 Safety requirements

The requirements for structure, protection against electric shock, energy and protection, overheating and fire, mechanical protection, electromagnetic compatibility, and marking and indication are mapped onto clauses 5.2 to 5.8 of GB 39752-2024.

The residual current device sits on the equipment side in a distributed arrangement, and on the equipment side or on the cabinet branch in a centralized one; the alternating-current output of the on-board charger-discharger is protected by a residual current device or by phase-to-earth insulation monitoring.

The discharge circuit is protected against overload, short circuit, overcurrent and undervoltage. On a frequency excursion the equipment disconnects within 0.2 s if the frequency falls below 49.5 Hz or rises above 50.2 Hz.

## 10 Performance requirements

The inrush current at start-up shall not exceed 1.1 times the rated peak alternating current.

For active power control at setpoints of 20 % and above, the error shall not exceed 3 % of the rated power, the response time shall not exceed 1 s and the settling time shall not exceed 3 s.

The clause also covers reactive power control, power quality, efficiency and the response to voltage and frequency variations.

## 11 Test methods

The clause gives the test procedure for each of the requirements above. Annex A defines how the response time and the control deviation of power setpoint control are measured.